

## **REMARKS**

The Office Action dated March 25, 2010, has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

By this Response, claims 2 and 11 have been amended to more particularly point out and distinctly claim the subject matter of the present invention. No new matter has been added. Accordingly, claims 2, 8, 11, 13, 14, and 16-19 are currently pending in the application, of which claims 2 and 11 are independent claims.

In view of the above amendments and the following remarks, Applicants respectfully request reconsideration of claims 2, 8, 11, 13, 14, and 16-19, and timely withdrawal of the pending rejections to the claims, for the reasons discussed below.

The Office Action rejected claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement. Specifically, the Office Action alleged that these claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that Applicants, at the time the application was filed, had possession of the claimed invention.

Regarding claims 2 and 11, the Office Action alleged that the specification does not provide sufficient support for a “first portion” and a “second portion,” as set forth in the pending claims. Applicants respectfully traverse this rejection for at least the following reasons.

The specification of the present application provides sufficient support for the “first portion” and the “second portion,” as recited in claims 2, 8, 11, 13, 14, and 16-19. For example, the specification, at least, on page 18, line 16, to page 19, line 8, clearly discloses providing a layered Fe-based alloy member with desired properties *only on a certain part* of the member. Further, the specification discloses that powder is applied to the certain part of the member, *i.e.*, the workpiece-pressing part of a forging punch – “a first portion,” so that an element of the powder diffuses *only* into that part of the member. Whereas, a large section 12 and a diametrically reduced section 14 of the member – “a second portion” do not have powder applied thereto. As a result, the Fe-based alloy member has desired properties along specific portions of the member.

Accordingly, the specification provides sufficient support for the “first portion” and the “second portion,” as recited in claims 2, 8, 11, 13, 14, and 16-19, to satisfy the written description requirement of 35 U.S.C. §112, first paragraph. Therefore, Applicants respectfully request withdrawal of the rejection of claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §112, first paragraph.

The Office Action rejected claim 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

Regarding claim 2, the Office Action alleged that there is insufficient antecedent basis for the limitation “the material,” as recited in line 8 of claim 2. The Office Action

alleged that it is unclear if “the material” refers to the “second element,” the “Fe-based alloy member,” the “coating,” or the “first element.”

Regarding claim 14, the Office Action alleged that it is unclear if the limitation “at the portion,” as recited in line 14 of claim 11, refers to the “first portion,” or the “second portion,” and therefore the claims are indefinite.

Applicants have amended claims 2 and 11 to more particularly point out and distinctly claim the subject matter of the invention. Specifically, claim 2 has been amended to replace “the material” with “the second element,” and claim 11 has been amended to recite, in part, “applying, to a surface of said Fe-based alloy member at the first portion, a powder comprising a substance that comprises said first element,” rendering the rejection of claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §112, second paragraph, moot. Therefore, Applicants respectfully request withdrawal of the rejection of claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §112, second paragraph.

The Office Action rejected claims 2, 8, and 16-19 under 35 U.S.C. §102(b) as being allegedly anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being allegedly unpatentable over Kaufman. The Office Action alleged that since Kaufman discloses substantially similar steps of treating the same or substantially the same composition, as recited in claims 2, 8, and 16-19, the thickness of the coating and the properties of the carbide, as recited in these claims, would be expected. Alternatively, the Office Action alleged that it would have been obvious to one having ordinary skill in the art to modify the size/quantity of the particles of alloy additive power having ingredients,

such as manganese, nickel and molybdenum, such that a thickness of 0.5 mm would be met since the ratio of base alloy powder to additive alloy powder is result-effective in terms of compressibility and cost. Applicants respectfully submit that claims 2, 8, and 16-19 recite subject matter that is neither disclosed nor suggested by Kaufman.

Claim 2, upon which claims 8 and 16-19 depend, recites a layered Fe-based alloy member. The layered Fe-based alloy member includes a coating disposed on an outer surface of a first portion of the layered Fe-based alloy member. The coating includes a carbide formed by carbonizing a first element that includes a property to increase a hardness of the layered Fe-based alloy member at the first portion. The coating further includes a thickness of at least 0.5 mm. The layered Fe-based alloy member further includes a second element disposed in a second portion of the layered Fe-based alloy member. The second element includes an amount that is greater on the outer surface than at an inside portion of the layered Fe-based alloy member. An amount of the first element is greater at the inside portion than on the outer surface of the layered Fe-based alloy member. A hardness of the layered Fe-based alloy member at the first portion is greater at the inside portion than on the outer surface of the layered Fe-based alloy member.

Applicants respectfully submit that Kaufman fails to disclose or suggest every element recited in claims 2, 8, and 16-19. Specifically, Kaufman fails to disclose or suggest, at least,

a coating disposed on an outer surface of a first portion of the layered Fe-

based alloy member, wherein the coating comprises a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy member at the first portion, and wherein the coating further comprises a thickness of at least 0.5 mm; and

a second element disposed in a second portion of the layered Fe-based alloy member, wherein the material comprises an amount that is greater on the outer surface than at an inside portion of the layered Fe-based alloy member,

wherein a hardness of the layered Fe-based alloy member at the first portion is greater at the inside portion than on the outer surface of the layered Fe-based alloy member,

as recited in claims 2, 8, and 16-19 (emphasis added).

The Office Action referred to column 5, lines 10-25, column 7, lines 12-31, and column 10, lines 26-29, of Kaufman to allege that Kaufman discloses or suggests every element recited in claim 2. In the *Response to Arguments*, the Office Action further alleged that the limitations for the “first portion” and the “second portion” do not preclude the “first portion” from being entirely or part of the “second portion,” and although Kaufman may begin with powders, Applicants have allegedly failed to demonstrate that Kaufman would lack the structure recited in claim 2. Applicants respectfully traverse this rejection of claims 2, 8, and 16-19 for at least the following reasons.

Embodiments of the invention are directed to providing a layered Fe-based alloy member with desired properties on *only a certain part* of the member, as disclosed in the specification, at least, on page 18, line 16, to page 19, line 8. Powder is applied *only to the certain part* of the member, *i.e.*, the workpiece-pressing part of a forging punch, so

that the element of the powder diffuses *only* into that part of the member. Therefore, the Fe-based alloy member has desired properties along specific portions of the member.

Kaufman is directed to a mechanical mixture of selected powders that are compressed into a pre-compact, whereby the pre-compact is subjected to liquid phase sintering for producing a raw alloy steel product. The mixture of selected powders prevents a premature solid state diffusion of carbon between and into the base iron particles. Certain metallic elements, particularly copper, may be used as an effective barrier to carbon loss during heating to the sintering temperature and while in the solid state condition (Kaufman, col. 4, lines 24-38).

Kaufman further discloses a technique for coating an Fe-C alloy powder and a technique for manufacturing a sintered body by using the coated Fe-C alloy powder. In particular, Kaufman discloses the use of a copper diffusion barrier applied as an envelope to *each particle* of the master alloy of powder in a controlled thin amount to control carbon loss during heating to a sintering temperature (Kaufman, col. 4, lines 24-45). Kaufman discloses that the powder supply is blended with the iron-base powder for making sintered alloy parts (*i.e.*, the final product). The coating of the Fe-C alloy powder is *unevenly distributed* on the surface of the sintered body (*i.e.*, the entire surface of each alloy part is sintered). Kaufman fails to further disclose or suggest that *only a certain portion* of the alloy parts is sintered with a coating for increasing the hardness at that certain portion, while *other parts* of the member are not coated with the coating.

Further, Applicants respectfully disagree with the allegations presented in the *Response to Arguments* section of the Office Action that the “first portion” and the “second portion” do not preclude the “first portion” from being entirely or part of the “second portion.” The specification of the present application clearly discloses that powder is applied *only to a certain portion* of the Fe-based alloy member, *i.e.*, the workpiece-pressing part of a forging punch – “a first portion,” so that an element of the powder diffuses *only* into that part of the member. Whereas, a large section 12 and a diametrically reduced section 14 of the member – “a second portion” do not have powder applied thereto. Thus, the Fe-based alloy member has desired properties along *specific portions* of the member. Therefore, one of ordinary skill in the relevant art would have clearly understand that the “first portion” and the “second portion” are separate portions of the Fe-based alloy member, and therefore the “first portion” would clearly not have been entirely or part of the “second portion,” as alleged in the Office Action.

Accordingly, Applicants respectfully submit that the Office Action failed to demonstrate that every element recited in claims 2, 8, and 16-19 is anticipated by, or in the alternative, obvious over Kaufman. Furthermore, claims 8 and 16-19 depend from, and further limit, claim 2. Accordingly, claims 8 and 16-19 should be allowable for at least their dependency upon an allowable base claim. Therefore, Applicants respectfully request withdrawal of the rejection of claims 2, 8, and 16-19 under 35 U.S.C. §102(b), or in the alternative, under 35 U.S.C. §103(a).

The Office Action rejected claims 2, 8, and 16-19 under 35 U.S.C. §103(a) as being allegedly unpatentable over Tahara alone, or alternatively, in view of the ASM Handbook, Volume 4, Heat Treating (“ASM Handbook”). The Office Action alleged that Tahara discloses every element recited in claim 2. In the alternative, the Office Action alleged that Tahara discloses every element recited in claim 2 with the exception of specifying the thickness of the carburized layer. The Office Action alleged that the ASM Handbook cures the deficiencies of Tahara. Applicants respectfully submit that claims 2, 8, and 16-19 recite subject matter that is neither disclosed nor suggested by Tahara or the ASM Handbook.

Applicants respectfully submit that Tahara fails to disclose or suggest every element recited in claims 2, 8, and 16-19. Specifically, Kaufman fails to disclose or suggest, at least,

a coating disposed on an outer surface of a first portion of the layered Fe-based alloy member, wherein the coating comprises a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy member at the first portion, and wherein the coating further comprises a thickness of at least 0.5 mm; and

a second element disposed in a second portion of the layered Fe-based alloy member, wherein the material comprises an amount that is greater on the outer surface than at an inside portion of the layered Fe-based alloy member,

wherein a hardness of the layered Fe-based alloy member at the first portion is greater at the inside portion than on the outer surface of the layered Fe-based alloy member,

as recited in claims 2, 8, and 16-19 (emphasis added).

Tahara discloses a *conventional* surface treatment technique for carburizing austenitic stainless steel. In particular, Tahara discloses a method of carburizing the austenitic stainless steel by holding the austenitic steel in a fluorine- or fluoride-containing gas atmosphere with heating prior to carburizing and carburizing the austenitic stainless steel at a temperature not more than 680°C. The austenitic stainless steel is stable and has 1 to 6 weight % molybdenum or 13 to 25 weight % chromium. The carburized hard layer has a corrosion resistance superior to a base material of the austenitic stainless steel (Tahara, Abstract).

One of ordinary skill in the relevant art would have understood that in a process of carbonizing, as discussed in Tahara, a carbide layer (*e.g.*, a hardened layer) is *unevenly distributed* at a surface layer portion (*i.e.*, on an outer surface) of the steel. Tahara fails to disclose that “a hardness of the layered Fe-based alloy member at the first portion is greater at the inside portion than on the outer surface of the layered Fe-based alloy member,” as recited in claims 2, 8, and 16-19 (emphasis added).

In the *Response to Arguments*, the Office Action, on page 6, alleged that the carbon discussed in Tahara diffuses and penetrates the surface to form a deep uniform layer, whereby chromium carbide can hardly be identified and more of the chromium is present in the steel than in the case (Tahara, col. 8, lines 1-22). On page 6, the Office Action further alleged that the structure disclosed in Tahara is the same as that of the instant invention, and therefore an increase in hardness from the surface to an inside portion thereof is expected. However, the Office Action failed to demonstrate that the

hardness of the member, as disclosed in Tahara, is greater at an inside portion than on an outer surface at a *first portion* of the member. The Office Action merely alleged that a uniform layer of carbide is applied to the entire member disclosed in Tahara. Tahara fails to disclose or suggest a “first portion” and a “second portion,” as recited in claims 2, 8 and 16-19. Therefore, Tahara alone fails to disclose or suggest every element recited in claims 2, 8, and 16-19.

The ASM Handbook fails to cure the deficiencies of Tahara. The ASM Handbook fails to disclose or suggest, at least, a “first portion” and a “second portion,” as recited in claims 2, 8, and 16-19.

Furthermore, as presented in the Response dated January 28, 2010, neither Tahara nor the ASM Handbook discloses or suggests, at least, a coating that comprises “a thickness of at least 0.5 mm,” as recited in claims 2, 8, and 16-19. The Office Action alleged that the limitation for the coating “comprising a thickness of at least 0.5 mm,” as recited in line 5 of claim 2, is not sufficient to distinguish the subject matter of the claims from the prior art references because the limitation *merely changes the proportion (thickness) of a prior art product* (see Office Action on page 6). In the alternative, the Office Action alleged that Tahara fails to specify the thickness of the carburized layer. The Office Action referred to the description in the ASM Handbook to allege that modifying time and/or temperature may achieve a carburized layer thickness greater than 1 mm, and, therefore, it would have been obvious to one of ordinary skill in the relevant art to have modified the time and temperature for the process discussed in Tahara to

achieve any desired carburized layer thickness (*see* Office Action on page 6). In the *Response to Arguments*, the Office Action further alleged that the carburizing time and temperature directly impacting the depth of carbon diffusion is well known in the art. Applicants disagree with the allegations presented in the Office Action.

As noted in the Response dated January 28, 2010, the Office Action failed to demonstrate that one of ordinary skill in the relevant art would have found it obvious to exceed the carburizing depth discussed in Tahara by a magnitude of over eight times, when Tahara explicitly discloses that the maximum depth of the carburized layer is limited to 70  $\mu\text{m}$ . Although one could have known from the ASM Handbook that carburizing time and temperature directly impact the depth of carbon diffusion, one would not have looked to modify Tahara, as alleged in the Office Action, because Tahara explicitly teaches away from a carburizing layer thickness having a magnitude of at least 0.5 mm. Modifying Tahara to provide a carburizing layer thickness of at least 0.5 mm would render Tahara unsatisfactory for its intended purpose. Thus, Tahara alone, or in the alternative, in combination with the ASM Handbook fails to disclose or suggest the thickness of the carburizing layer recited in claims 2, 8, and 16-19. Accordingly, assuming *arguendo* that Tahara could be combined the ASM Handbook, such a combination fails to disclose or suggest every element recited in claims 2, 8, and 16-19.

Furthermore, claims 8 and 16-19 depend from, and further limit, claim 2. Accordingly, claims 8 and 16-19 should be allowable for at least their dependency upon an allowable base claim. Therefore, Applicants respectfully request withdrawal of the

rejection of claims 2, 8, and 16-19 under 35 U.S.C. §102(b), or in the alternative, under 35 U.S.C. §103(a).

The Office Action rejected claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §103(a) as being allegedly unpatentable over Wang. The Office Action acknowledged that Wang fails to explicitly disclose every element recited in these claims. The Office Action alleged that it would have been obvious to one of ordinary skill in the relevant art to modify the temperature of the coating to form the desired coating thickness recited in these claims. Applicants respectfully submit that claims 2, 8, 11, 13, 14, and 16-19 recite subject matter that is neither disclosed nor suggested by Wang.

Claim 11, upon which claims 13 and 14 depend, recites a method for producing a layered Fe-based alloy member having an increased hardness at a first portion of the member from an outer surface to an inside portion thereof. The member includes a coating disposed on an outer surface of the first portion of the member. The coating includes a thickness of at least 0.5 mm and a carbide formed by carbonizing a first element that includes a property for increasing the hardness of the Fe-based alloy member. The member further includes a second element, other than the first element, disposed in a second portion of the member, whereby the second element includes an amount that is greater on the outer surface than at the inside portion of the member. An amount of the first element increases from the outer surface to the inside portion. The method includes applying, to a surface of the Fe-based alloy member at the first portion, a powder including a substance that comprises the first element. Further, the method

includes heat-treating the Fe-based alloy member with the powder applied thereto, so that the first element is diffused to the outer surface of the member at the first portion. The first element reacts with carbon existing in the outer surface of the Fe-based alloy member to form the carbide.

Applicants respectfully submit that Wang fails to disclose or suggest every element recited in claims 2, 8, 11, 13, 14, and 16-19. Specifically, Applicants respectfully submit that Wang fails to disclose or suggest, at least,

a coating disposed on an outer surface of a first portion of the layered Fe-based alloy member, wherein the coating comprises a carbide formed by carbonizing a first element that comprises a property to increase a hardness of the layered Fe-based alloy member at the first portion, and wherein the coating further comprises a thickness of at least 0.5 mm; and

a second element disposed in a second portion of the layered Fe-based alloy member, wherein the material comprises an amount that is greater on the outer surface than at an inside portion of the layered Fe-based alloy member,

wherein a hardness of the layered Fe-based alloy member at the first portion is greater at the inside portion than on the outer surface of the layered Fe-based alloy member,

as recited in claims 2, 8, and 16-19 (emphasis added), and similarly recited in claims 11, 13, and 14.

The Office Action alleged that Wang discloses a “first portion” and a “second portion” because Wang allegedly includes a portion having a carbide layer and a second portion that does not have a carbide layer (*see* Office Action on page 13).

Wang is directed to a steel composition. Wang discloses chain parts and other

steel articles (“the members”) that are provided with a hard, wear-resistant carbide coating by tumbling them in a heated retort with a particular mix that includes a source of vanadium and/or niobium (Wang, col. 2, line 60, to col. 6, line 12). The members disclosed in Wang *are completely coated* with the carbide. Therefore, contrary to the allegations presented in the Office Action, carbide is coated at *every portion* of the members disclosed in Wang. Therefore, Wang fails to disclose or suggest that a hardness of the members *at a first portion* is greater at an inside portion thereof than on an outer surface of these members (*i.e.*, the hardness of the members would be uniform throughout).

Furthermore, at column 3, line 13, and column 6, lines 39-40, Wang discloses that the steel is immersed in ferrovanadium (FeV), ferroniobium (FeNb), or mixed FeV/FeNb. Wang also discloses, at column 3, lines 21-29, that halide vanadium or halide niobium draws carbon (*see* chemical equation). Hence, one of ordinary skill in the relevant art would have understood that Wang discloses that carbon is drawn from the steel by displacement of halide (*i.e.*, Cl in the exemplified equation). One would have further understood that such a reaction mechanism is distinguishable from the diffusion mechanism disclosed for embodiments of the present invention.

Furthermore, according to the reaction mechanism disclosed in Wang, only carbon diffuses toward a surface of the steel, and a composition ratio of vanadium or niobium does not change. Therefore, one would have understood that Wang fails to disclose or suggest that the composition of the layered Fe-based alloy member “*at the first portion* is

greater at the inside portion than on the outer surface of the layered Fe-based alloy member,” as recited in claims 2, 8, and 16-19 (emphasis added), and similarly recited in claims 11, 13, and 14. Accordingly, the Office Action failed to demonstrate that every element recited in claims 2, 8, 11, 13, 14, and 16-19 is obvious over Wang.

Furthermore, claims 8 and 16-19 depend from, and further limit, claim 2. Claims 13 and 14 depend from, and further limit, claim 11. Accordingly, claims 8, 13, 14, and 16-19 should be allowable for at least their dependency upon an allowable base claim. Therefore, Applicants respectfully request withdrawal of the rejection of claims 2, 8, 11, 13, 14, and 16-19 under 35 U.S.C. §103(a).

Applicants respectfully request reconsideration of claims 2, 8, 11, 13, 14, and 16-19. Applicants respectfully submit that claims 2 and 11, and the claims that depend therefrom, are now in condition for allowance.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, Applicants’ undersigned representative at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

/Brad Y. Chin/

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Brad Y. Chin  
Attorney for Applicants  
Registration No. 52,738

**Customer No. 32294**

SQUIRE, SANDERS & DEMPSEY LLP  
14<sup>TH</sup> Floor  
8000 Towers Crescent Drive  
Vienna, Virginia 22182-6212  
Telephone: 703-720-7800  
Fax: 703-720-7802

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